

Diesel Pumping Efficiency Program

A Multi-Purpose Resource Management Program



Helping California to...

- Clean the Air
- Conserve Water
- Conserve Energy
- Protect Water Quality



Peter Canessa – Program Manager...

- ❑ M.S. Irrigation and Drainage
- ❑ Registered Agricultural Engineer in California
- ❑ 30 Years in Ag Water and Energy Management
 - Teaching at Cal Poly – SLO & CSU Fresno
 - 10 yrs consulting in Ag energy efficiency programs for PG&E
 - Irrigation scheduling and system design software
 - Non-point source pollution reduction/control programs
 - Water conservation program design and implementation
 - Consultant to San Diego County Water Authority in IID-SDCWA water transfer
 - NSW, Australia – on-farm and irrigation district-level water management improvements
 - Program Manager – Ag Peak Load Reduction Program
 - Program Manager – Ag Pumping Efficiency Program



DPEP – How does it do all this?...

1. Improving the overall pumping plant efficiency
2. Improving management of the plant

In other words...

- Get more water production for every gallon of diesel burned and...
- Thus, decrease emissions per unit water produced, while...
- Minimizing the amount of water pumped



DPEP – The Foundation Thesis...

The pumping plant is a SYSTEM of 3 mechanical components and one human component...

1. The engine itself
2. Power transmission - driveshaft, v-belts, right-angle drives, etc.
3. The pump itself
4. Management
 - ☐ Specification/design of the pumping plant
 - ☐ Maintenance of the pumping plant
 - ☐ Operation of the pumping plant



DPEP Foundation Thesis...

To the extent that there are INEFFICIENCIES in any one of these components then emissions are increased...

1. Emissions per unit water are increased – inefficient hardware
2. Pumping time is increased – inefficient management



DPEP Focus – the PUMP itself...

- ❑ An efficient pump will produce more water per gallon of diesel consumed than an inefficient pump
- ❑ Thus, an efficient pump results in less emissions per unit water produced
- ❑ An efficient pump is like an efficient engine – no matter how long it is run, emissions are reduced



DPEP – Analogy to automobiles

- ❑ Programs like Moyer reduce emissions by reducing the emissions per gallon fuel consumed (Tier III/IV engines).
- ❑ Programs like DPEP reduce emissions by improving fuel economy (higher pumping plant efficiency) thus, reducing emissions per gallon of water produced.



DPEP Implemented on Pilot Basis...

- ❑ Funding:
 - West Coast Collaborative
 - Valley CAN

- ❑ Total Goals (all goals exceeded!):
 - 69 pump efficiency tests
 - 11 pump retrofit projects

- ❑ Geographic Area:
 - Central and Southern San Joaquin Valley



DPEP Results...

- ❑ 69 Pump Efficiency Tests total, 58 were before retrofits (57 wells, 1 booster) w/ 17.1% average OPE (22-24% attainable)
- ❑ 20 wells and 1 booster committed to repairs
- ❑ 11 pump retrofit projects completed with 11 post-tests

	Before	After
OPE	13.8%	23.2%
GPM	742	1025
Brake HPinput	80	86
Engine RPM	1734	1696
Input HP-hrs per ac-ft	2237	1319

- ❑ Implied emissions reduction – average pump repair 3.4 tons NOx and 0.15 tons PM10
- ❑ Average direct cost per project (two tests plus rebate) - \$3,615



Results for Individuals...

- ❑ Average 3,180 gallons diesel/year saved
- ❑ Average \$3,115/project rebate
- ❑ Average \$12,800 project cost (per invoices)

Implied simple payback @ \$2.00/gallon...

- ❑ $\text{Cost} = \$12,800 - \$3,115 = \$9,685$
- ❑ $\text{Savings} = \$2.00/\text{gal} \times 3,180 \text{ gal/yr} = \$6,360/\text{yr}$
- ❑ **Payback = $9,685 / 6,360 = 1.5 \text{ yrs}$**



DPEP – Phase II Just Completed...

- ❑ Help develop pump test infrastructure
- ❑ Components:
 - Complete pump test calculation/report/databasing software
 - Instructions for fuel flow device construction and operation
 - On-site visits to transfer knowledge
- ❑ Funding: Valley CAN



Verification of Emissions Reduction...

Moyer:

- Keys on emissions/hour
- Per unit reduction verified by engine manufacturers
 - is engine kept in tune, run at correct rpm and load?
 - persistence of engine performance?
- total emissions determined based on hour meter – self-reported unless inspected

DPEP:

- Keys on emissions/Ac-Ft
- Per unit reduction verified by in-field pump test
 - test at normal operating conditions?
 - persistence of pump performance?
- Total units determined based on flow meter – self reported unless inspected



Verification of Emissions Reduction...

- ❑ Verification for DPEP can be achieved to same level of confidence as current Moyer
 - Per unit reduction by accepted measurements - standard pump efficiency test vs. manufacturer's data
 - Same types of variances apply - manufacturing tolerances, tune of engine, management of engine, persistence
 - Total emissions based on an accepted (and self-reported meter) – hour meter for current Moyer, flowmeter for DPEP

- ❑ Current Moyer guidelines allow for non-engine measures



Next Step...

Full-scale Diesel Pumping Efficiency Program for 3-5 years

- ~ 800 pump tests/year
- ~ 100-125 pump retrofit/rebuild projects/year
- ~ 10 educational seminars in field/year + educational materials
- Numbers based on current census of engines and “what market will bear”



Anticipated Results from Full-Scale DPEP...

- ❑ Assuming similar results from the pilot projects we anticipate the following for a 3-year program of 125 pump retrofits/year:
- ❑ 1,275 tons reduced NOx emissions
- ❑ 56.25 tons reduced PM10 emissions
- ❑ 1,192,500 gallons reduced diesel usage
- ❑ In the range of 10,000 tons reduced CO2 (@ 17 lbs CO2/gallon diesel consumed)

(Note – the EPA estimates 22.2 lbs CO2/gallon diesel at <http://www.epa.gov/otaq/climate/420f05001.htm>)



Diesel Pumping Efficiency Program...

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Also – see www.pumpefficiency.org for information on the Ag Pumping Efficiency Program (the model for DPEP)

